E. D. C. BAYNE & L. A. SUBERS.
UNWOVEN REINFORCED FABRIC.
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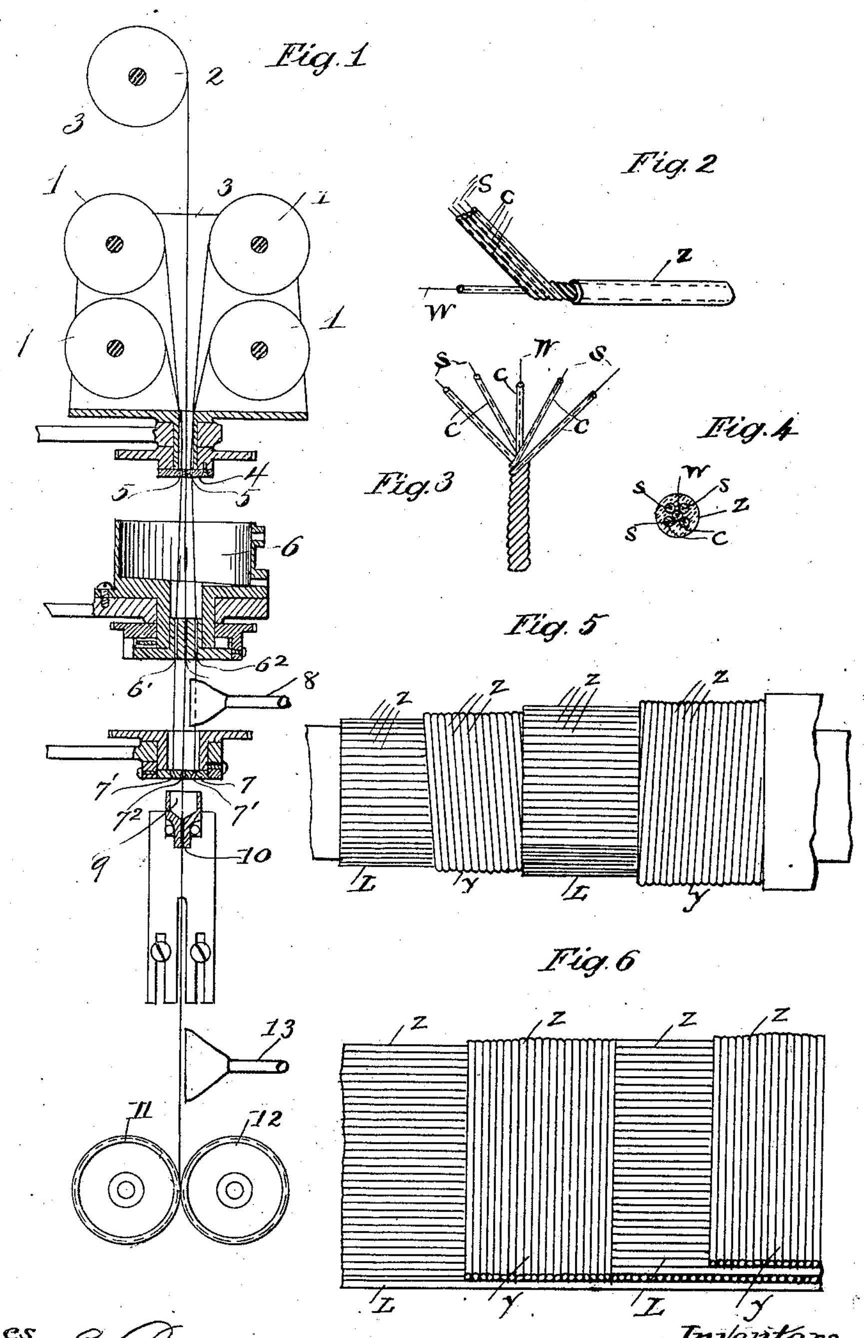
940,779. Patented Nov. 23, 1909.



Witnesses

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EUGENE D. C. BAYNE AND LAWRENCE A. SUBERS, OF CLEVELAND, OHIO.

UNWOVEN REINFORCED FABRIC.

940,779. Specification of Letters Patent. Patented Nov. 23, 1909.

Application filed April 20, 1908. Serial No. 428,015.

To all whom it may concern:

Be it known that we, EUGENE D. C. BAYNE and LAWRENCE A. SUBERS, citizens of the United States, and residents of Cleveland, in the county of Cuyahoga, State of Ohio, have invented certain new and useful Improvements in Unwoven Reinforced Fabric, of which we declare the following to be a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

The objects of the invention are to provide an unwoven reinforced fabric of a similar character to the fabric described in an allowed application for Letters Patent of the United States, bearing Serial No. 370,139, filed April 25th, 1907, in which an unwoven fabric composed entirely of fibrous cords or threads and rubber is described, and in which each fibrous cord or thread comprises a plural number of fibrous strands, each strand previously coated with rubber before winding or twisting and each cord or thread coated with rubber after winding or twisting, and the coated cords or threads laid in parallel rows in layers of cords or threads with thin coatings adhering together in close contact, the several rubber coatings being sufficient to prevent actual contact of the individual threads and strands in the completed fabric. By means of this form of construction the completed fabric when vulcanized is characterized by extreme durability, flexibility and resistance to tension in the direction in which the threads are laid and strength is obtained in more than one direction by changing the direction of laying the thread in alternate layers to cross each other at any desired angle.

This invention is designed to provide for a greater strength, durability and efficiency of the fabric than can be obtained by the aforesaid fabric without reducing its actual flexibility and the result is obtained by introducing a reinforcing central strand into each cord or thread and thereby composing each thread substantially as shown and described in our previous application for Letters Patent of the United States, for reinforced cord or thread, bearing Serial No. 411960. From cords or threads of substantially this character the improved reinforced fabric is made.

The fabric is formed of unwoven cords or threads composed of previously coated fibrous strands and a central previously coated preferably metallic strand of great tensile strength and fineness, so as not to diminish its flexibility.

The fibrous strands are wrapped or twisted about the central metallic strand in such a manner as to completely inclose it, and to so thoroughly incorporate it among the fibrous strands that no amount of bending or folding of the cord or thread will result in the protrusion or cutting out of the metal.

Heretofore it has often been attempted to insert a metallic shield or woven wire in certain fabrics, such as automobile tires or other fabrics subject to abrasion or puncture, but the inclosure of metallic plates or rods or netting within a yielding substance such as rubber and fiber has invariably resulted in the gradual cutting by the metal through the substance of the envelop, and the protrusion of the metal in such a manner as to destroy the efficiency of the fabric.

One of the important features of this invention therefore is to permit of the incorporation with the fabric of a relatively large percentage of metallic element to resist puncture and abrasion and to increase greatly the tensile strength of the fabric without injury to the fabric, and if tubular to increase its resistance to internal pressure and at the same time to so distribute equally the metallic element throughout all parts of the fabric by enveloping it in each separate cord or thread so that the metallic elements will be flexible and thoroughly incorporated with the separated cords or threads composing the fabric and be therefore incapable of breaking through or separating the strands, cords or threads at any point or lessening the durability thereof, but on the contrary greatly augments the efficiency and durability of the fabric.

The process of forming the fabric may be described as follows:

The individual strands previously coated are wound or twisted upon a previously coated central metallic strand such as a fine steel wire specially prepared to resist any chemical action of the coating and the completed cord or thread is subsequently coated with a distinct envelop preferably of the same material with which the strands are coated.

The wrapping of the fibrous strands is close and tight about the wire so that no portion of the wire, when the cord or thread is completed, is exposed and an additional wrapping of coated strands at a different angle may be placed over the first wrapping if it is desired to form a larger cord or thread.

It is obvious that by varying the size of the central wire and wrapping strands that a cord or thread of any desired diameter or weight can be produced.

The threads are then laid in the same manner as described in said previous application for non-reinforced fabric, and the forms of the device employed in wrapping the fibrous strands about the central wire strand to form a cord or thread and the manner of forming the fabric from parallel cords or threads arranged in layers crossing each other to obtain tensile strength in more than one direction are illustrated in the accompanying drawings, hereinafter described and specifically pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical central section of the device for coating and wrapping or twisting strands and for coating the cord or thread and shaping the coating into cylindrical compact form; Fig. 2 is an elevation of a portion of the completed cord or thread showing a part of the wrapped or twisted strands unwound; Fig. 3 is a similar view showing the manner in which the machine wraps or twists the fibrous strands about the wire strand; Fig. 4 is a transverse section (enlarged) of the finished cord or thread; Fig. 5 is an elevation of a piece of tubular fabric formed from the reinforced cords or threads; and Fig. 6 is a plan view of a flat piece of fabric similarly formed.

A detailed description of the automatic devices for coating the strands and cord or thread is given in an application for Letters Patent thereon filed in connection herewith and hence need not be given herein. It is sufficient to say that 1, 1 are spools of fibrous strands, 2 is a spool of wire or other reinforcing material mounted upon a suitable support 3, 4 is a rotatable plate perforated centrally to form a guide for the wire, and in a circle thereabout, perforated at 5, 5, to form guides for the strands to be wrapped or twisted about the wire. These fibrous and wire strands pass through a bath 6 of the non-fibrous coating substance such as rubber and then pass through a combined rotating twister, guide and applicator in the bottom thereof at 6, 6, and then through a correspondingly perforated plate 7, which all rotate at a predetermined rate of speed so as to wrap or twist the coated fibrous strands about the coated wire in the required number of strands to the inch. The speed being determined by the relative size of the strands, and by the relative diameter and weight of a cord or thread, and designed to form a closely and tightly wound fibrous wrapping or sheath to prevent the wire from cutting its way out.

The coatings are dried by means of air blasts conducted as shown through flaring mouthed tubes 8, 8 and the cord or thread is then drawn through one or more baths or applicators supplied with rubber, as shown at 9, and having a single central opening. The exterior coating thereby applied is compressed and shaped into a substantially cylindrical form by means of rollers 10 and 11 after having been sufficiently dried to solidify the rubber to required degree by means of an air blast, 12.

It is obvious that additional coatings of rubber can be applied by increasing the number of applications thereof and additional wrappings of fibrous strands can be applied in the same direction or at an angle thereto to increase the strength and size of the cords or threads.

The strands are wrapped or twisted as they pass through the rubber applying device.

In Figs. 2 and 3 the coated fibrous strands S are shown wrapped about a central coated wire strand W, and an exterior coating Z envelops the thread. The coatings C for each strand separate the strands out of actual contact with each other and the outer coating Z forms with these separate coatings a homogeneous mass enveloping all the strands and adapted to separate the adjacent cords or threads when laid in the fabrics, from actual contact with each other and thus preserve them, thus preventing the cords or threads and their component strands, from rubbing upon and abrading each other, or exercising frictional action of any sort on each other.

The fabric if cylindrical is preferably formed upon a mandrel as shown in Fig. 5 and one layer Z is laid of parallel threads longitudinally and the next Y transversely and so on to the required thickness.

Alternating layers may be laid at different angles if desired so as to increase the tensile strength in all directions and prevent irregularities in laying the thread from forming openings.

The cords or threads may be laid in flat layers as shown in the next Fig. 6, to form sheets or belts of fabric and any desirable outer covering may be employed.

The several cords or threads and layers are connected together by means of the adhesion of their coatings and the final process of vulcanizing completes a homogenous product, characterized by extreme flexibility and being without friction among its component strands, cords or threads is more durable under all kinds of strain and flexure.

It will be observed that layers of the reinforced fabric may be used in connection with layers of non-reinforced fabric where the tensile strength is sufficient without greater reinforcement, one or more layers of reinforced fabric being interposed to augment the strength of the other fabric.

We believe ourselves to be the first to combine metallic and fibrous elements in a fabric together and with vulcanizable rubber or other plastic and elastic material without weaving, and in such a manner as to utilize the full strength of the metallic element without accumulating the metal to a disadvantageous degree at any one point, but attenuating and thoroughly distributing and incorporating the metallic element throughout the fabric which maintains the flexibility and increases the tensile strength thereof.

It is obvious that the central reinforcing strand may be a central fibrous strand adapted to increase the tensile strength of each cord or thread and being perfectly straight will lessen the tendency of the finished cord or thread to stretch, and assist in giving cohesion and shape thereto.

The strength of the finished cord or thread is greatly augmented by the friction of the outer strands upon the central reinforcing strand, which opposes a strong resistance to any movement whatever of the outer strands thereon, such as would be caused by longitudinal strains, which would tend to elongate the spirally twisted or wrapped strands.

An important advantage derived from the use of the reinforced strand is found in the resistance of each cord or thread and consequently the entire fabric to stretching, since the central strand is straight relatively to the spirally wound or wrapped exterior strands, and the strength of each cord or thread is greatly increased thereby.

When a central fibrous strand is employed in connection with outer fibrous strands, the tensile strength is increased about one-fifth over that of a cord or thread in which the relatively straight central strand is not employed.

The aggregate breaking strain of all the fibrous strands which envelop the central metallic strand should preferably be greater than that of the breaking strain of the metallic strand, so as to cause all the strands comprising the thread to break together, for the reason that the outer strands are not twisted together, but are wrapped or twisted about the central strand and hence are not collectively as strong as if twisted together. This condition is however reversed in a cord or thread having a central fibrous strand, since the breaking strain sustainable by the central strand will be equal to or greater than the strain sustainable by the several exterior strands. In this manner a flat fabric, as for belting, or tubular structures such as hose pipe are obtained, which will not stretch perceptibly and will also be characterized with great flexibility and durability in use.

The thickness of the coatings may be varied at pleasure to suit the circumstances of each case. It may merely be stated that if the coatings are too thick the strength of the fabric is reduced and if not sufficiently thick the act of vulcanizing will almost remove them so that the strands and cords or threads will not be sufficiently out of contact with each other; a medium treatment therefore is preferable.

Having described the invention what we claim as new and desire to secure by Letters Patent is:

1. A reinforced fabric made of a layer of parallel threads laid closely together and a superimposed layer of parallel threads arranged transversely to the threads of the first named layer, the threads of each layer being composed of united fibrous strands and a central reinforcing strand upon which said fibrous strands are wound, each of said strands having a coating thereon, of elastic, "non-fibrous" material, said coatings being adhesive to join the threads together, said threads when laid in said fabric separated by adhesive coatings adapted to join the threads together and sufficiently thick to maintain them out of contact with each other.

2. A reinforced fabric made of alternating layers of parallel wrapped threads, each thread comprising a group of united metallic and fibrous strands, and arranged longitudinally and transversely therein, the threads in one layer crossing the threads in alternate layers at an angle, each strand being coated with a flexible, non-fibrous material, and the fibrous strands wrapped around the metallic strand, and each thread when laid in the fabric separated from adjoining threads by a coating of vulcanizable material, said coatings being adhesive to join the strands to one another and to join the threads and layers together.

3. A reinforced fabric made of a layer of longitudinally extending threads and superimposed layers of alternately transversely and longitudinally extending threads, the threads in each layer comprising united metallic and fibrous strands, each strand having a coating thereon of non-fibrous material and the several threads being separated from each other by means of vulcanizable coatings, said coatings being adhesive to join the said strands together, and to join the threads together at the time the fabric is made, the said threads being united under pressure and maintained out of actual contact by said coatings.

4. A reinforced cylindrical fabric com-

prising a layer of parallel spirally disposed threads, and a layer of longitudinally disposed threads, the threads of each layer comprising strands of fibrous material united together, each strand having a coating of non-fibrous vulcanizable material thereon, a similarly coated wire strand in some of the same threads about which said fibrous strands are wound, said threads separated from each other by adhesive coatings of vulcanizable material, the said coatings being of sufficient thickness to place said strands and threads out of actual contact with each other.

5. A reinforced fabric comprising coated threads adhering together, some of the threads composed of metallic coated strands and coated fibrous strands wrapped thereon, and some of the threads composed wholly of coated fibrous strands adhering together, the said threads being laid in layers alternately longitudinal and transverse the said coatings being non-fibrous, elastic and vulcanizable.

6. A reinforced fabric composed of unwoven adhering threads, the said threads comprising each a central reinforcing coated strand and exterior coated fibrous strands, and the threads and strands coated with non-fibrous, flexible material the said coatings being adhesive and vulcanizable whereby said strands are attached together, the said coatings operating to separate said threads and strands out of actual contact with each other.

In testimony whereof we hereunto set our hands this 18th day of April 1908.

EUGENE D. C. BAYNE.
LAWRENCE A. SUBERS.

In presence of—
A. T. OSBORN,
L. L. SEITH.